

ARRANGEMENT MODEL OF SABA RIVER ESTUARY AREA BASED ON TOURISM ENVIRONMENT FOR WATER CONSERVATION IN BU LELENGREGENC

by I Gusti Agung Putu Eryani

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SUSTAINABILITY DESIGN AND CULTURE

DENPASAR, OCTOBER 20TH, 2017

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ARRANGEMENT MODEL OF SABA RIVER ESTUARY AREA BASED ON TOURISM ENVIROMENT FOR WATER CONSERVATION IN BULELENG REGENCY

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ABSTRACT

River estuary is downstream part of the river that associated with the sea. The river water flowing from upstream to downstream will be wasted to the sea through the river estuary (Loloan). The water that flows in a river was a water surface due to rain, springs, groundwater and waste or household waste. This research will organize the Saba River estuary area in Buleleng Regency based on tourism environment, for water conservation. The whole Watershed that flows in Buleleng regency bali province drain its water towards the sea through the downstream river / estuary of the river. River estuary / Tukad Saba is one of the downstream located in Buleleng Regency with parenial type. where much of the flow is a rice field, river estuary area Saba has not laid out properly. It needs to be planned for area arrangement based tourism environment. River estuary is the water body area where the entry of one or more of the river to the sea, kedanau, dams, ocean or river to another larger. In coastal areas, river estuary deeply affected by inland water conditions such as freshwater and sediment flow. and sea water such as tidal, wave, and the influx of salt water inland. Depending on the location and the environmental conditions, estuaries may contain many biological niches within a small area, and so is associated with high biodiversity. The results of measurements of water discharge in the river estuary Saba in the dry season of 0,26 m³/sec and in the rainy season amounted to 1,023 m³/sec. Potential water in the estuary of the Saba of 9.34 million m³/year can be used for the water industry (hotel) 1364 rooms, for domestic water 81.854 inhabitants, for a fish pond of 2 ha and 148 ha of irrigation water. Arrangement of estuary area of the river Saba of the environmental aspects of tourism can be implemented with the availability of hazard map, clean water can be met as needed, illumination walkways such street lights are designed appropriately, the opening of the circulation path effluent from the coast toward the riverbank and the construction of a jetty for the smooth of discharge flow of the river to the sea.

Keyword: *Estuaries, Tidal, Wave, Arrangement.*

A. INTRODUCTION

A.1 Background

The estuary of the river serves as the expulsion or disposal of the river especially during the flood to the sea. The estuary of the river has important economic value because it can serve as a connecting link between the sea and the deep land area. The problem that often encountered is that the amount of sediment in the mouth of the river so that the flow of the stream becomes small which can disrupt the discharge of river flow into the sea.

The estuary of the large rivers can shape estuaries and also delta according to Ross D.A. (1995). The river estuary is the downstream part of the river associated with the sea. The ground area

that drains water to a water body is called watersheds or drainage basins. Water that flows from land to a body of water is called surface run off, and the water flowing in the river to the sea is called river run off. Approximately 69% of the water that entering the river comes from rain, melting ice / snow, and the remainder comes from groundwater, the entire water that flowing is water resources (Effendi, 2003).

The rivers flowing in Province Bali is the Balinese River Basin Unit consisting of 391 watersheds (PU Bali, 2012). There are rivers in Bali that purified by Hindus because the river is usually used in religious ceremony. The rivers in Bali flow to the north and south due to the division

of Bali Island by the mountains that stretch from the east - west of the island. The water of the river flows from upstream to downstream will be expelled into the sea through the estuary or loloan.

Water that flows in the river is the surface water due to rain, springs, ground water and waste or household waste disposal. The population of the world increases in daily, it is resulting in the need for quality and quantity of water also increases, while the availability of water sources in the world that can be used directly as clean water that has a human consumption threshold is not much, every day humans need clean water to drink, Cooking, bathing, washing and so on and about 80% will be disposed of in a dirty and polluted form known as wastewater.

The mouth of the Saba River is located in Buleleng Regency. That area during the rainy season is often the occurrence of high water flows due to the delayed flow of river water into the sea. This is happen because the sediment transport along the beach settles right at the mouth of the river, so the river water overflows, threatening the facilities and infrastructure that exist in the estuary of the River Saba. Morphological Characteristics of the Estuary of Saba River on the Coast of Seririt Buleleng. The morphology of the Saba estuary is dominated by tidal and low tide of sea with mouth of ± 8.5 m estuary, its spreading area towards north east.

The eroded of soil and tides of sea, which of course often happens at the mouth of the Saba River. The increase of population and the demand for a better livelihood has encouraged people to keep trying to meet all their needs, but behind it there will be negative impacts, especially on the river water and river mouth. Industrial waste and household waste that transported by the rivers for years continue to increase. Therefore, it is necessary to evaluate the environmental condition

of the river estuary and the arrangement of the environment to support water needs and tourism activities.

Potential availability of water in downstream areas of the river or Saba estuary is also expected to be utilized as a supporter of raw water, so that it is not left useless to the sea during the rainy season, but can be accommodated for water potential supporters during the dry season. Surface water that flows in the mouth of the river until now has not been maximally utilized for the community's raw water needs, so the water is wasted in the sea.

A.2 The Aim of the Research

The aim of the research is to:

1. Evaluate the environmental conditions of the Saba River estuary Buleleng regency.
2. Arranging the river estuary environment to support water conservation and tourism activities in Buleleng Regency.

B. LITERATURE STUDY

B.1 The Estuary

Estuary or river estuaries are semi-enclosed to waters that are freely connected to the sea. The combination of sea and freshwater influences will produce a distinctive community, with varying environmental conditions, includes: Where tidal currents with opposing tides flow in, lead to a strong influence on sedimentation, water mixing, and other physical features, and carry great influence on its biota. The mix of two kinds of that water produces a special environmental physics that is not the same as the nature of river and sea properties.

B.2 The Management of Estuary

There are two the estuary managements that are for the mouth of the river is always open so that the mouth of the river is always open required two

long jetties to avoid sedimentation in the groove of the mouth of the river and the formation of the tongue of sand. Estuary of the river may be closed where there are two options, that is the mouth of the river should not be turned or may move. Deflection of the mouth of the river may cause the river growing longer and may reduce its ability to pass the discharge. To withstand the deflection of the estuary of the river needs to make medium jetty, short jetty, building on river banks or routine sediment dredging, according to Triatmodjo (1999).

B.3 Establishment of Estuary River in the Context of Urban Management

Urban management (urban management) is part of spatial planning as an approach that includes space water (sea), land space and space (air).

1. Elements of City Design.

According Shirvani (1985) there are 8 elements that need to be studied in an urban design that are: Land Use, Building and Mass, Circulation and Parking, Open Space, Pedestrian Ways, Activity Support, Signage and Preservation Systems.

2. City Identity and City Image

According to Budihardjo (1997), the identity of the city can be formed based on the architectural style of the building, the function and the role in the urban system itself, the socio-cultural values that live in society, the welfare aspect that become the variety of spirit and behavior in the community, even the flora and fauna that can display special characteristics and become the pride of society.

B.4 Establishment of River Estuary in Waterfront Context

1. Waterfront Definition and Classification

The term Waterfront is an area / part of the city which can become an assembly point in all waterland and it also as a dynamic area in those city.

2. Waterfront Development Concept

According to Torre (1989) several aspects of the study that help to the way become success in the development of water areas are: theme, image, experience, function, forming public opinion, environmental assessment, technological aspects, financing and management.

According to Ichsan (1993), there are characteristic in abroad area that develop a building especially in water area, there are:

1. The development of waterfront area is built toward the water.
2. People consciously appreciate the development of nature area without changing it.
3. The benefit of the existence in waterfront is the quality of the nature area itself, we can see the panorama view as a beautiful background.
4. There are specific rules included: coastline, river, lake boundaries to avoid coastal ownership for the benefit of individuals.

B.5 Establishment of River Estuary in Tourism City

Urban tourism have to develop because sector of the tour will have profit aspect toward the city that can increase the locally-generated revenue. Therefore is needed to reins and keep the quality in tourism city, so that the tour object can work continuity. In the basic of tourism object is an open room that can be consumed by people. Room

which can be used by people are not see the age and gender, and also it can give the opportunity for kind of activity, and can be classified in type of space. In addition the guarantee of security and comfort along with the free access for doing recreational activities in it, is a absolute requirment to stimulate human appreciation of the tourist attraction.

B.6 Establishment of River Estuary in Law Context

The general rule about coastal line, mention that minimal the coast border line is 100 meter which measured by the highest water face toward 127 land line. (Presidential Decree no. 32 of 1990 on protected area management). The management of the river border area shall be regulated in chief minister of general workers 63 / PRT / 1993 section 6, on the boundary line of the river. The border line of the river is defined as follows:

- A. The border line of the river shouldered outside the urban area, set at least 5 (five) meters on the outside along the foot of the embankment.
- B. The borderline of the embankment in the urban area, set at least 3 (three) meters on the outside along the foot of the dike.

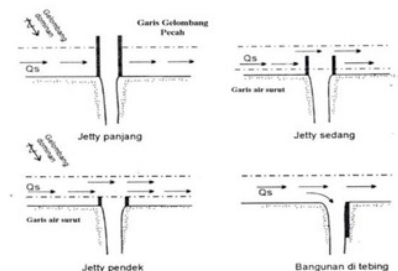


Figure 1. Jetty Type for River Estuary
(Source: Triatmodjo (1999))

B.7 Establishment of River Estuary in Context Public Participation

The word role and comes from "participation", which Balai Besar Bahasa Indonesia dictates that Balai Pustaka is "role - as well". The Role-Participatory Approach can be defined as a pattern of approaches in the development process involving various actors, in a form of partnership in equality, by applying the role-and-role system. The community participates as the subject of development as well as the object of enjoying the results of development.

C. METHODOLOGY

C.1 Methodology

The method which the author use is descriptive qualitative. It has several consideration as follows:

- The focus of the analysis on the device of qualitative is bigger than quantitative.
- The relation of human's subjectivity on one of the spatial planning in such regions.

C.2 Time and Place of Research

The place of the research is located on the estuary of Saba River on Buleleng district, where located in Pengastulan beach. Look at Figure 2.



Figure 2. The Location of the Research
(Source: author)

C.3 Method of Data Collection

The data which is used for this research is divided into primary data and secondary data.

1. Primary data

The process of data collection is through:
direct observation, qualitative interview, and regional mapping.

2. Secondary data

The data is taken from related institution for example: Bali Penida River hall area, Bali's BPS, the Office of Environmental Agency in Bali's Province.

The aspects of the analysis:

1. Main Physic Aspect

The aspect on this analysis is related to regional mapping in DAS, so the geomorfology of the analysis is connected to the opportunities of the using and controlling area. The analysis of climatology is about temperature aspect, himidity, wind, rainfall, direct sun radiation which have purpose to get a suitable functions of the city toward DAS' climate character.

Patlima (2007) said that the main key of the qualitative approach is the research itself. So, the researcher have to be validate of how far the analysis which can be continue to the further field research. The qualittative approach as the Human Instrument have a function to set the focus of the analysis, choose the respondent as the source of the data, data collection, data qualitatve measurement, data analysis, transcribing the data, and make a conclusion of everything.

3.4 Technique of Data Analysis

The technique which the author choose in this research is qualitative data analysis. This analysis is done on the field with Interactive Technique Analysis Model by Miles and Huberman. In this model, the data reduction and data presentation is considering the data which is collected by the researcher. At the last step of the analysis is making inference and verification of the data.

D. RESULTS AND DISCUSSION

D.1 Result of the Data

The result is can be inferred as follows: the morphology characteristic of Saba River is having typology of inverted triangle with the acre 141,424 km², and the length of the main river is 36,070 km. The morphology characteristic of the Saba's River estuary is dominated by stream flow with the wide of the water gate of river 8,5 m, which the stream flow towards to the water gate is constant. The structuring of region Saba's water gate and coastal area Pengastulan in Buleleng regency could be arrangement as:

1. Structuring of the basic physical aspects of the area

The concept and model of the basic physical aspects of the area are as follows:

- The concept of regional arrangement in the form of a safety embankment along the river, the revitalization (urban renewal) and development control through clear legal institutions.
- The concept of security along the river embankment was made along the riverbank with stone and concrete materials. High embankment of at least 3 (three) meters and the embankment area is used as a circulation path.
- The concept of revitalization (urban renewal) is applied to areas that have

not been organized and tend to seem slums, which along the banks of rivers and coastal areas, especially in residential areas.

Surface water discharge measurements at the Saba River estuary were conducted in September (dry season) and in January (rainy season). Estuary of Saba river located in coastal area Pengastulan Seririt Village, Buleleng Regency, for the implementation of debit measurements conducted at a distance of 100 m - 110 m from the edge of the beach using a tool current meter. Water debit studies at the water gate of the river are measured at low tide during the dry and rainy seasons. The result of the measurement of water debit at Saba River estuary in dry season is $0,156 \text{ m}^3 / \text{second}$ and in rain season $1,023 \text{ m}^3 / \text{second}$. Potential water in the estuary of the Saba of 9.34 million m^3/year can be used for the water industry (hotel) 1364 rooms, for domestic water 81 854 inhabitants, for a fish pond of 2 ha and 148 ha of irrigation water. Management with the reservoir and dam movement.



Figure 3. Morphological Conditions of Saba River Estuary during Dry and Rainy Season.
(Source: author)



Figure 4. Implementation of Measurement of Saba River Estuary at Pengastulan Beach
(Source: author)



Figure 5. Elevation Measurement Process at Saba River Estuary
(Source: author)



Figure 6. Water Retrieval Process Of Estuary River from the Bridge In Pengastulan Village
(Source: author)



Figure 7. Water Retrieval Test Process in Estuary of Saba River Seririt Buleleng
(Source: author)



Figure 7. Water Retrieval Test Process in Estuary of Saba River Seririt Buleleng
(Source: author)



Figure 8. Water Retrieval Process for Water Quality Test at Saba River Estuary, Pengastulan
(Source: author)

D.2 Viewed from the Environmental Aspects of Tourism

The concept of this tourism environmental aspect is divided into the following sections:

a) Environmental facilities must exist:

1. Disaster Map and clean water
2. Each road must have street lighting.

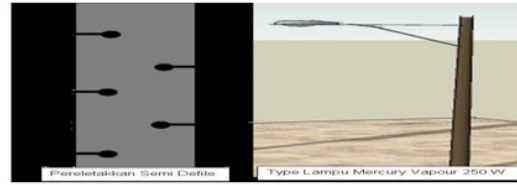


Figure 9. Street Lighting On The Road
(Source: www.google.com)

b) Roads and Pedestrians

1. Open the circulation path from the coastal to the river.
2. Utilize the location of the river bank embankment.



Figure 10. Circulation Path from the Coastal to the River.
(Source: www.google.com)

- c) Need to be made a safety dike on the river banks and breakwater waves in a jetty type of river.
- d) Should be made river water controller door.
- e) Need to have a post / tower on the beach.
- f) Each house should have its own recharge wells, in order to reduce the burden of environmental drainage channels.
- g) The existing drains need to be covered with a concrete plate (a safety factor) but it should also be made with the main hole.

D.3 Jetty Building Planning

Jetty is a perpendicular beach building located on both sides of the river estuary that serves to reduce the deepening of the grooves by beach

sediments. In the use of estuary river as a cruise line, sedimentation in the estuary can disrupt the vessel traffic. For its purpose jetty must be long until the tip is outside of the break wave. With long jetty delivery of sediment can also be used to prevent siltation in the estuary, in relation to flood control. The rivers that lead to sandy beaches with considerable waves often encountered obstruction of the estuary by sand deposits. Due to the influence of waves and winds, sand deposits formed in the estuary. Delivery of sediment along the coast is also very influential on the formation of the sediment.

The sand that passes in front of the estuary will be driven by the incoming waves into the estuary and then deposited. Very large sediments can cause the clogging of estuary rivers. The closure occurs in the dry season where the river discharge is small so that it is unable to erode the sediment. The closure of the estuary can cause flooding in the upper part of the estuary. In the rainy season the floodwater can erode the sediment so little by little the river mouth reopens. During the process of closure and re-opening it is usually accompanied by turning the estuary river in the same direction as the direction of sediment delivery along the coast. The appropriate construction for the Saba estuary area arrangement is a medium Jetty building, with its ends being between the low tide level and the location of breaking waves and can withstand sediment transport along the coast.

Direction of jetty is determined by the position of the estuary of the river, where based on the bathymetry map and to adjust the position of the existing embankment, the jetty's direction is determined as 15°5'25,8" oblique to the east calculated from the north according to the existing river flow site which can be seen from the seabed contour of the bathymetry.

E. CONCLUSION

1. Morphological Characteristics of Saba River has an inverted triangular typology with the watershed area is 141,424 km², with the main river length 36,070 km. The morphological characteristics of Saba River estuary is dominated by river water discharge at the river estuary mouth width 8.5 m, the direction of water flow at the mouth of the estuary remains.
2. The result of the measurement of water debit at Saba River estuary in dry season is 0,156 m³/second and rainy season is 1,023 m³/ sec. The potential of water at Saba river estuary of 9.34 million m³/ year can be used for industrial water (hotel) 1,364 rooms, for domestic water 81,854 people, for fish pond of 2 ha and irrigation water equal to 148 ha.
3. Arrangement of estuary river area is implemented with tourism environmental aspect consist of the following sections: Environmental facilities must have a clearly illustrated disaster map, clean water is provided as needed. Each street environment is paired with street lighting and open the circulation path from the coastal to the river.
4. Utilizing the location of river and beach safety embankment (with jetty type breakwater building).

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